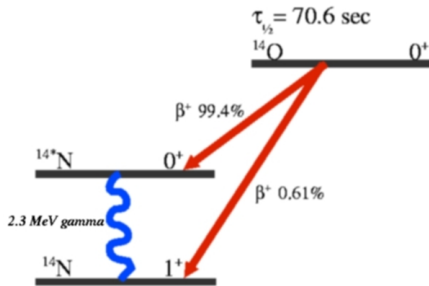


# Testing the CVC Hypothesis in the Beta Decay of $^{14}\text{O}$

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The Conserved Vector Current (CVC) hypothesis, of the electroweak theory, predicts a distortion of the allowed beta decay spectrum. CVC modifies the allowed spectrum by introducing an energy dependent shape factor ( $a_{\pm}$ ) that is directly related to the width of the electromagnetic M1 transition in the isobaric analog state. CVC has been tested in the  $A = 12$  ( $^{12}\text{B}$ ,  $^{12}\text{C}$ ,  $^{12}\text{N}$ ) system. Several experiments have arrived at varying conclusions. An experiment in the  $A = 14$  ( $^{14}\text{C}$ ,  $^{14}\text{N}$ ,  $^{14}\text{O}$ ) system is desirable due to the large shape factor predicted by CVC,  $a = 5.5$  % per MeV. The experiment has been difficult to perform to high precision due to the small branching ratio to the  $0^+ \rightarrow 1^+$  branch of approximately 0.6 percent, see decay scheme below [1].



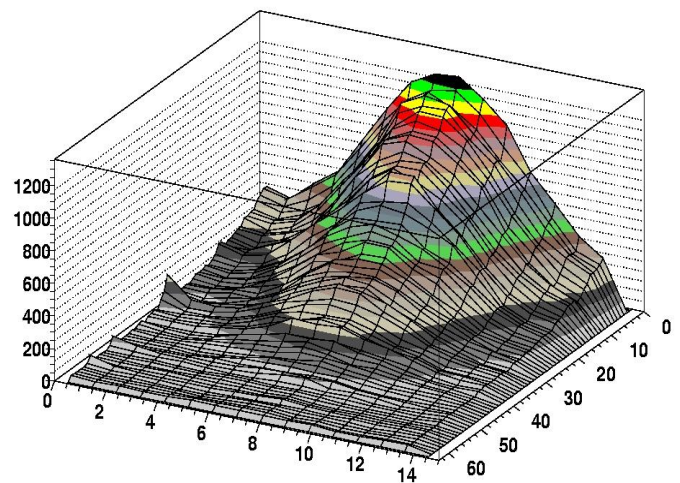
We will measure the shape factor using a flat-field magnetic spectrometer with a multi-wire proportional chamber detector. The acceptance of the spectrometer is on the order of  $10^{-4}$ . In order to test the theory to the level of the theoretical calculations we require a point like source of  $^{14}\text{O}$  of at least  $10^7$  atoms for several days. Due to the short, 70 second, half-life of  $^{14}\text{O}$  it must be produced on-line at the 88" Cyclotron. The  $^{14}\text{O}$  is produced by  $^{12}\text{C}(^3\text{He},n)^{14}\text{O}$  reaction.

The target consists of a low density carbon aerogel which is resistively heated to 2000 degrees Celsius. The  $^{14}\text{O}$  bonds to  $^{12}\text{C}$  in the target forming  $^{12}\text{C}^{14}\text{O}$  molecule predominately.

The  $^{12}\text{C}^{14}\text{O}$  diffuses from the target into a transfer line connected to the electron cyclotron resonance Ion Source for Radioactive ISotopes (IRIS ECR). The  $^{12}\text{C}^{14}\text{O}$  is dissociated, ionized, and extracted at up to a 30 kV. The ion beam travels through an analyzing magnet and the  $^{14}\text{O}$  isotope is focused and embedded into a thin beryllium foil, forming a fixed point like source for the experiment.

During 2001 the beta spectrometer and proportional wire chamber detector were moved to the experimental area. The spectrometer was coupled with the IRIS test stand and a test run was performed on December 8 and 9 2001. The spectrum of the Fermi branch was measured, see below. The 0 to 64 range shows the 64 vertical wires and the 0 to 16 range shows the 16 horizontal channels.

Oxygen-14 Beta Spectrum Analysis



## Footnotes

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## References

- 1. G.S. Sidhu and J.B. Gerhardt, Phys. Rev. 148, 1024 (1966).